Original document

LIGHT SCAN TYPE DISPLACEMENT MEASURING APPARATUS

Patent number: JP9257418
Publication date: 1997-10-03

Inventor: HASHIMOTO TAKESHI; ITO TAKAYASU; HIRONO ATSUYUKI
Applicant: MATSUSHITA ELECTRIC WORKS LTD

Classification:
- international: *G01B11/00; G01C3/06;* **G01B11/00; G01C3/06;** (IPC1-7): G01B11/00; G01C3/06
- european:
Application number: JP19960069862 19960326
Priority number(s): JP19960069862 19960326

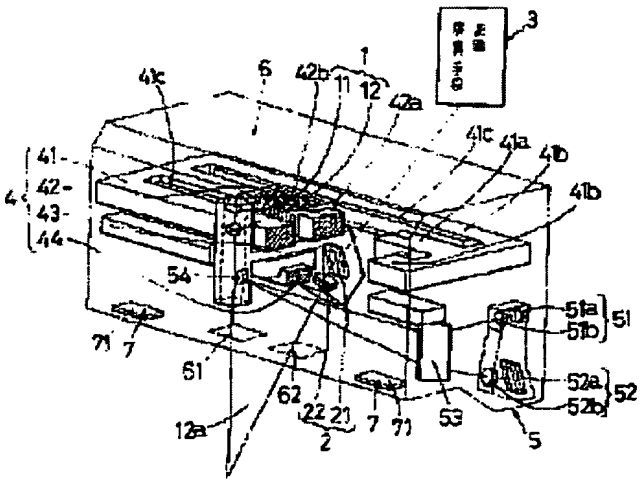
View INPADOC patent family

Report a data error here

Abstract of **JP9257418**

PROBLEM TO BE SOLVED: To maintain the position of a light beam in the direction of scanning at a specified position initially set accurately for a long time by calibrating the degree of deviation from the specified position of the light beam in the direction of scanning by a calibration means.

SOLUTION: A photodetecting means 2 focuses reflected light from a projection spot with a photodetecting lens 22 and forms an image on a photodetecting surface of a position detector 21 to output two types of current signals. A distance computing means 3 computes a distance from a reference surface of an object to be measured to a surface displaced therefrom based on the output signals. A photodetecting section 52 of a position detecting means 5 focuses the reflected light from a reflecting plate 54 with a photodetecting lens 52b for detecting positions and forms an image on a photodetecting surface of a position detecting element 52a to output two types of current signals. A calibration means 7 computes with an arithmetic part current signals outputted from position detectors 71 respectively provided in housings 6 positioned at both ends of a scanning range of a light beam thereby calibrating the degree of deviation from an initially set



CLAIMS

[Claim(s)]

[Claim 1] A floodlighting means to irradiate a light beam and to form a floodlighting spot in a device under test, A light-receiving means to receive the reflected light from a floodlighting spot and to output a signal corresponding to the light-receiving location, A distance operation means to calculate the distance from the datum level of a device under test to the datum level and the displaced displacement side based on the signal from a light-receiving means, A scan means for the stand which attached the floodlighting means and the light-receiving means in the orientation to run, and to scan a light beam, Have a location detection means to detect the location in the scanning direction of a light beam, and a light beam scans the front face of a device under test. In the light-scanning mold displacement measurement equipment measured as the triangulation method which measures the triangle of the light emitting/receiving flat surface formed with the floodlighting shaft of a light beam and the light-receiving shaft of the reflected light in the distance from a datum plane to a displacement side is also Light-scanning mold displacement measurement equipment characterized by establishing a proofreading means to proofread the amount of gaps from the predetermined location of said light beam in a scanning direction.

[Claim 2] Light-scanning mold displacement measurement equipment according to claim 1 characterized by coming to be formed as it is also at the location sensing element which said proofreading means is formed in the both ends of the scanning zone of said light beam, respectively, and detects the location of said light beam.

[Claim 3] Light-scanning mold displacement measurement equipment according to claim 1 characterized by said stand being contained by housing, one of the photo interrupters with which it is shaded with two or more gobos or its gobo, and said proofreading means outputs a protection-from-light signal being prepared in a stand, and another side being established in housing, and coming to be formed.

[Claim 4] Light-scanning mold displacement measurement equipment according to claim 1 characterized by said light beam being irradiated through a floodlighting aperture, and coming to form said proofreading means as it is also at a floodlighting aperture shorter than the scanning zone of said light beam.

[Claim 5] Light-scanning mold displacement measurement equipment according to claim 1 characterized by coming to form said proofreading means in the scanning zone of said light beam as the diffuse reflection body which allots said two or more

displacement sides displaced from said datum plane to a predetermined location, and carries out diffuse reflection of said light beam is also.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] A light beam scans the front face of a device under test, and this invention relates to the light-scanning mold displacement measurement equipment which measures the distance from the datum level of a device under test to the datum level and the displaced displacement side based on a triangulation method.

[0002]

[Description of the Prior Art] Conventionally, the thing of a configuration of being shown in drawing 9 exists as this kind of light-scanning mold displacement measurement equipment. A floodlighting means A for this thing to irradiate a light beam at a device under test, and to form a floodlighting spot A light-receiving means B to receive the reflected light from a floodlighting spot and to output a signal corresponding to the light-receiving location B1 A distance operation means to calculate the distance from the datum level of a device under test to the datum level and the displaced displacement side based on the signal from a light-receiving means, The thing equipped with a scan means for the stand which attached the floodlighting means A and the light-receiving means B in the orientation to run, and to scan a light beam, and a location detection means to detect the location in the scanning direction of a light beam exists.

[0003] In more detail, the floodlighting means A is with the light source sections A2, such as semiconductor laser, and floodlighting lens A3, and the light-receiving means B is formed, respectively with photo detector B-2 which detects a location, and the light-receiving lens B3. When the datum plane A1 of a device under test displaces, it can measure that the triangulation method which measures the triangle of the light emitting/receiving flat surface C formed by floodlighting shaft A5 of a light beam and light-receiving shaft B4 of the reflected light in the distance from a datum plane A1 to displacement side A4 is also.

[0004] Namely, if the distance of the light-receiving angle formed by the die length, floodlighting shaft A5, and light-receiving shaft B4 of the perpendicular taken down from the core of the light-receiving lens B3 to floodlighting shaft A5, and the

light-receiving lens B3 and photo detector B-2 is set as constant value, respectively It can also measure that it is to survey distance from the light-receiving location B1 of the reflected light in datum level A1 to light-receiving location B5 in displacement side A4, the distance of displacement, i.e., amount, from datum level A1 to displacement side A4.

[0005] Moreover, the location detection means was formed by the floodlighting section, the light sensing portion, and distance operation part, and has detected the location in the scanning direction of a light beam by the above-mentioned principle of a triangulation method.

[0006]

[Problem(s) to be Solved by the Invention] With the above-mentioned conventional light-scanning mold displacement measurement equipment, when a light beam scans the front face of a device under test and receives the reflected light from a device under test, the variation rate of the device under test from datum level can be measured.

[0007] However, a location detection means to detect the location of a light beam had the case where it shifted from the predetermined location where input-output behavioral characteristics, such as a light sensing portion or distance operation part, may change with secular change etc. from initial value, and the location of the light beam in a scanning direction was set up in early stages at this time. For example, when a scanning zone was set to 100mm, supposing input-output behavioral characteristics changed 0.1%, it became the amount of gaps of 0.1mm, and this had become an error.

[0008] This invention is what was made in view of the above-mentioned reason, and the place made into the purpose is to offer the light-scanning mold displacement measurement equipment which can maintain the location in the scanning direction of a light beam in the predetermined location set up in early stages.

[0009]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, a thing according to claim 1 A floodlighting means to irradiate a light beam and to form a floodlighting spot in a device under test, A light-receiving means to receive the reflected light from a floodlighting spot and to output a signal corresponding to the light-receiving location, A distance operation means to calculate the distance from the datum level of a device under test to the datum level and the displaced displacement side based on the signal from a light-receiving means, A scan means for the stand which attached the floodlighting means and the light-receiving

means in the orientation to run, and to scan a light beam, Have a location detection means to detect the location in the scanning direction of a light beam, and a light beam scans the front face of a device under test. In the light-scanning mold displacement measurement equipment measured as the triangulation method which measures the triangle of the light emitting/receiving flat surface formed with the floodlighting shaft of a light beam and the light-receiving shaft of the reflected light in the distance from a datum plane to a displacement side is also It is made the configuration in which a proofreading means to proofread the amount of gaps from the predetermined location of said light beam in a scanning direction was formed.

[0010] The thing according to claim 2 is made the configuration formed as it is also at the location sensing element which said proofreading means is formed in the both ends of the scanning zone of said light beam, respectively, and detects the location of said light beam in the thing according to claim 1.

[0011] In the thing according to claim 1, said stand is contained by housing and the thing according to claim 3 is made the configuration which one of the photo interrupters with which it is shaded with two or more gobos or its gobo, and said proofreading means outputs a protection-from-light signal was prepared in the stand, and another side was established in housing, and was formed.

[0012] In the thing according to claim 1, said light beam is irradiated through a floodlighting aperture, and the thing according to claim 4 is made the configuration in which said proofreading means was formed as it is also at a floodlighting aperture shorter than the scanning zone of said light beam.

[0013] The thing according to claim 5 is made the configuration formed as the diffuse reflection body with which said proofreading means allots said two or more displacement sides displaced from said datum plane in the scanning zone of said light beam to a predetermined location, and carries out diffuse reflection of said light beam is also in the thing according to claim 1.

[0014]

[Embodiment of the Invention] The 1st operation gestalt of this invention is explained below based on drawing 1 thru/or drawing 4 .

[0015] 1 is a floodlighting means, it forms the floodlighting lens 12 which consists of the light source section 11 which consists of semiconductor laser or light emitting diode, and transparence resin, becomes that the beam of light which emitted light from the light source section 11 is also for the floodlighting lens 12 with a parallel pencil of rays, irradiates a light beam on the surface of a device under test, and forms a floodlighting spot.

[0016] 2 is a light-receiving means, the light-receiving lens 22 which consists of the 1st location sensing element 21 which consists of a semi-conductor, and transparence resin is formed, it converges that the light-receiving lens 22 is also about the reflected light from a floodlighting spot, image formation is carried out to the light-receiving side of the 1st location sensing element 21, and the 1st location sensing element 21 outputs two kinds of current signals to both ends corresponding to an image formation location, i.e., a light-receiving location.

[0017] 3 is a distance operation means and calculates the distance to the displacement side displaced with datum level to the datum level of a measurement object based on two kinds of current signals outputted by arithmetic elements, such as a microcomputer, from the 1st location sensing element 21.

[0018] 4 is a scan means and is formed with York 41, the needle 42, the stand 43, and the guide rail 44. York 41 was formed in the shape of ****** by central piece 41a and piece of opposite 41b with the magnetic material, and piece of two opposite 41b has fixed permanent magnet 41c to the opposed face of central piece 41a, respectively. Two permanent magnet 41c is magnetized so that the opposed face of central piece 41a and the root face of piece of opposite 41b may become a unlike pole, and so that the opposed face of central piece 41a may become a like pole, respectively.

[0019] A needle 42 has bobbin 42a in which central piece 41a was inserted, and coil 42b is wound around bobbin 42a so that the line of magnetic force passing through the inside of bobbin 42a may be formed in the longitudinal direction of central piece 41a. Moreover, bobbin 42a has set up the dimension so that transit may become free at the longitudinal direction of central piece 41a. When magnetic flux will pass in the gap of permanent magnet 41c and central piece 41a of York 41 and a direct current energizes coil 42b, driving force will act and a needle 42 will run along with the longitudinal direction of central piece 41a. Moreover, the direction of transit of a needle 42 is reversed according to the energization direction of the current passed to coil 42b, and acceleration is equivalent to the magnitude of a current.

[0020] A stand 43 fixes the floodlighting means 1 and the light-receiving means 2 to an orientation, is attached in a needle 42, runs the means along with the longitudinal direction of central piece 41a, and scans a light beam. A guide rail 44 is formed in abbreviation parallel along with the longitudinal direction of York 41, and it is guided so that a stand 43 may be engaged, it may shake and it can run that there is nothing.

[0021] 5 is a location detection means and is formed by the floodlighting section 51, the light sensing portion 52, the reflecting mirror 53, the reflecting plate 54, and distance operation part (not shown). The floodlighting section 51 prepares

floodlighting lens 51b for location detection which consists of light source 51a which consists of semiconductor laser or light emitting diode, and transparence resin, becomes that the beam of light which emitted light from light source 51a is also for floodlighting lens 51for location detection b with a parallel pencil of rays, and irradiates a light beam.

[0022] A light sensing portion 52 prepares light-receiving lens 52b for location detection which consists of 2nd location sensing element 52a which consists of a semi-conductor, and transparence resin, and it converges that light-receiving lens 52for location detection b is also about the reflected light from the reflecting plate 54 mentioned later, and image formation of it is carried out to the light-receiving side of 2nd location sensing element 52a, and it outputs two kinds of current signals to both ends corresponding to the image-formation location.

[0023] A reflecting mirror 53 is formed in the housing 6 later mentioned so that the floodlighting shaft of the light beam from the floodlighting section 51 may be intersected, reflects a light beam, and changes the direction. With a white ceramic plate, it is fixed to the side face of the floodlighting cylinder which contained the floodlighting means 1, and a reflecting plate 54 is interlocked with the scan of the light beam from the floodlighting means 1, and moves to a scanning direction. Based on two kinds of current signals outputted from 2nd location sensing element 52a, distance operation part calculates the distance to a reflecting plate 54, and outputs the result of an operation.

[0024] 6 is housing, it is fabricated in the shape of an abbreviation rectangular parallelepiped, and holds each of the floodlighting means 1, the light-receiving means 2, the distance operation means 3, the scan means 4, and the location detection means 5, and the part 62 located in the light-receiving shaft of the part 61 and the reflected light which are located in the floodlighting shaft of a light beam is carrying out opening, respectively.

[0025] 7 is a proofreading means, forms the operation part 72 which calculates the current signal outputted to the housing 6 which consists of a semi-conductor and is located in the both ends of the scanning zone of a light beam from the 3rd location sensing element 71 prepared one piece at a time, respectively and the 3rd location sensing element 71, and detects the location of the light beam from the floodlighting means 1. About this thing, it mentions later in detail.

[0026] Here, the floodlighting means 1 and the light-receiving means 2 are arranged so that the floodlighting shaft of a light beam and the light-receiving shaft of the reflected light may form light emitting/receiving flat-surface 12a, and it intersects

perpendicularly with this light emitting/receiving flat-surface 12a, and the light-receiving side of the 1st location sensing element 21 is established. Therefore, if the datum level of a device under test displaces in the direction of radiation of a light beam, the image formation location of the device under test which carried out image formation will move to the light-receiving side of the 1st location sensing element 21. If the movement magnitude of the image formation location of this device under test is calculated as it is also with the distance operation means 3, and it is calculated based on the output of the 1st location sensing element 21, the distance from the datum level of a device under test [in / that it is also at the principle of the triangulation method which carried out point ** / the direction of radiation of a light beam] to that datum level and the displaced displacement side can be measured.

[0027] Moreover, a stand 43 is made to reciprocate using the scan means 4, a light beam is scanned, and it is detected that the location of the light beam in the scanning direction is also with the location detection means 5. That is, the light beam from the floodlighting section 51 is irradiated toward a reflecting plate 54 through a reflecting mirror 53, and incidence of the reflected light from a reflecting plate 54 is similarly carried out to 2nd location sensing element 52a through a reflecting mirror 53. Here, the floodlighting shaft of a light beam and the light-receiving shaft of the reflected light from a reflecting plate 54 form a light emitting/receiving flat surface through a reflecting mirror 53, and the light-receiving side of 2nd location sensing element 52a is established so that it may intersect perpendicularly with this flat surface.

[0028] The location of the light beam in a scanning direction is interlocked with, the location of a reflecting plate 54 changes, and the image formation location of a reflecting plate 54 moves in respect of light-receiving of 2nd location sensing element 52a. If the movement magnitude of the image formation location of this reflecting plate 54 is calculated as distance operation part is also, and it is calculated based on the output of 2nd location sensing element 52a, it can ask for the location of a reflecting plate 54, i.e., the location of the light beam in a scanning direction, that it is also at the principle of the triangulation method which carried out point **. Here, in the first stage, the predetermined location of the light beam in a scanning direction is determined that even two kinds of current values outputted from 2nd location sensing element 52a are.

[0029] Proofreading of the amount of gaps from the predetermined location of the light beam in a scanning direction is described. Two kinds of currents receive the light beam from the floodlighting means 1, and the 3rd location sensing element 71 is outputted. The difference of both current outputs supports the image formation location on the light-receiving side of the 3rd location sensing element 71, and the

sum of both current outputs corresponds to the total light income which receives light, and is fixed in this case.

[0030] As shown in drawing 2 , each of both the current signals outputted from the 3rd location sensing element 71 is changed into a voltage signal in I/V conversion circuit 72a of the circuit section, and the high frequency component modulated by modulation circuit 72c is extracted by passing high-pass filter 72b. From oscillator-circuit 72e, the output of high-pass filter 72b synchronizes, a synchronous detection is carried out to a clock pulse by 72d of detector circuits, and a low-frequency component is extracted from a detection output by low pass filter 72f. A low pass filter 72f output becomes the voltage signal of the value which is proportional to each current output of the 3rd location sensing element 71, respectively. Both the voltage signal is added and subtracted at 72g of adder circuits, and 72h of subtractor circuits, respectively, and the division of the difference which it is as a result in division circuit 72i is done by the sum. This division output value turns into a value corresponding to an image formation location.

[0031] Here, as shown in drawing 3 , the image formation location of a light beam is decided by deciding a fixed threshold value to be the correspondence relation to which the division output value which did the division of the difference of both the outputs of the 3rd location sensing element 71 by the sum, and the image formation location corresponded.

[0032] Correspondence with the output value and the predetermined location of a light beam by the location detection means 5 in the scanning direction of a light beam is shown in drawing 4 . In the first stage, as shown in the continuous line of drawing 4 , the predetermined location Y of a light beam supports the linear in the straight line expressed with the output value X and Y=aX+b by the location detection means 5, and the location of a light beam calculates it by the distance operation part of the location detection means 5 based on this straight line, and it is called for. And the 3rd location sensing element 71 detects the location of a light beam respectively corresponding to the image formation location of the light beam which the predetermined location equivalent to the both ends 71a and 71b of this straight line calculated from the threshold value.

[0033] As the input-output behavioral characteristics of the location detection means 5 change, an output location is changed and it is shown in the broken line of drawing 4 In the predetermined location of the light beam which is equivalent to the both ends 71a and 71b of the straight line detected by the 3rd location sensing element 71 when the gap from a predetermined value occurs a and b in a front type are amended to a

right value, and the amount of gaps from the predetermined location of a light beam is proofread so that the output value of the location detection means 5 may turn into an early output value.

[0034] If it is in the light-scanning mold displacement measurement equipment of this 1st operation gestalt Since the proofreading means 7 proofreads the amount of gaps from the predetermined location set up in early stages of the light beam in a scanning direction as described above, the input-output behavioral characteristics of a location detection means 5 to detect the location of a light beam change with secular change etc. from initial value. When the location of a light beam shifts from a predetermined location, a light beam can be proofread in a predetermined location, and the location precision in the scanning direction of a light beam can be maintained for a long period of time.

[0035] Moreover, since the proofreading means 7 was formed as it is also at the 3rd location sensing element 71 which detects a location with high degree of accuracy, establish a threshold value and the location of a light beam is detected with a sufficient precision. Since the light beam could be proofread with high degree of accuracy in the predetermined location and it was prepared in the both ends of the scanning zone of a light beam, respectively, a gap of the location from a predetermined location can be proofread by two points of both ends, and proofreading precision can be made still higher.

[0036] In addition, although the proofreading means was formed with the 1st operation gestalt as it is also at the 3rd location sensing element which outputs two kinds of currents and detects the location of a light beam with the difference of the output, you may form that the charge-coupled device (CCD) which prepared the electrode array on the silicon substrate is also for example, and it is not limited that are highly precise and what is necessary is just the component which can detect the location of a light beam.

[0037] Moreover, with the 1st operation gestalt, although it measured that an optical triangulation method was also about the location in the scanning direction of a light beam, other optical ranging methods like the optical measurement method which used the linear encoder, or an optical heterodyne ranging method may be used, and it is not limited, for example.

[0038] The 2nd operation gestalt of this invention is explained below based on drawing 5 . In addition, with the 2nd operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and about the 1st operation gestalt and the member which has the same function substantially, the same sign is attached and

explanation is omitted.

[0039] 8 is a proofreading means and the photo interrupter 82 is formed in the housing [in / in two gobos 81 / the both-ends location of a scanning zone] 6 at the stand 43, respectively. A photo interrupter 82 is interlocked with the scan of a light beam, a location moves it, it is shaded that a gobo 81 is also in the both ends of a scanning zone, a protection-from-light signal is outputted, and a location [in / that it is also with the protection-from-light signal / the scanning direction of a light beam] is detected.

[0040] If it is in the light-scanning mold displacement measurement equipment of this 2nd operation gestalt As described above, two gobos 81 in housing 6 [the proofreading means 8] Since the photo interrupter 82 which is shaded with the gobo 81 and outputs a protection-from-light signal was prepared and formed in the stand 43 Since the number of gobos 81 is two, a gap of the location from a predetermined location will be proofread by two points, proofreading precision can be made high, a complicated digital disposal circuit cannot be needed, but the location of a light beam can be detected as it is also with a direct protection-from-light signal, and a cost cut can be realized.

[0041] The 3rd operation gestalt of this invention is explained below based on drawing 6 **** drawing 7 . In addition, with the 3rd operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and about the 1st operation gestalt and the member which has the same function substantially, the same sign is attached and explanation is omitted.

[0042] 9 is formed as it is also at the floodlighting aperture 91 which is a proofreading means and was prepared in housing 6, and a short **** setup of the floodlighting aperture 91 is carried out from the scanning zone of a light beam. Therefore, in the both ends of a scanning zone, a light beam is covered with housing 6. When the ceramic plate 92 of white with a sufficient diffuse reflectance is put on a datum plane and a light beam is scanned, as shown in drawing 7 , the light income of the 1st location sensing element 21 of the light-receiving means 1 changes at the both ends of the floodlighting aperture 91, and forms a ramp. When light income of the floodlighting aperture 91 within the limits is set to X, the location of a light beam is detected by making 0.5X into a threshold value.

[0043] Since the proofreading means 9 was formed as it is also at the floodlighting aperture 91 shorter than the scanning zone of a light beam as described above if it was in the light-scanning mold displacement measurement equipment of this 3rd operation gestalt, the location of a light beam can be detected by change of the light

income of the light-receiving means 1 in the both ends of the floodlighting aperture 91, it is not necessary to add a member newly, and a cost cut can be realized.

[0044] In addition, although the white ceramic plate was placed and proofread to datum level with the 3rd operation gestalt, if a diffuse reflection factor is good, you may not be a ceramic plate and it will not be limited.

[0045] The 4th operation gestalt of this invention is explained below based on drawing 8 . In addition, with the 4th operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and about the 1st operation gestalt and the member which has the same function substantially, the same sign is attached and explanation is omitted.

[0046] A proofreading means is formed in the abbreviation mold for L characters by the piece of positioning prepared by carrying out an abbreviation rectangular cross from the piece of criteria and the piece of criteria with datum level 101 with the diffuse reflection body 10 which carries out diffuse reflection of the light beam, and two displacement sides 102 displaced from datum level are established in the scanning zone of a light beam. The piece of positioning engages with housing 6, is positioned, and the displacement side 102 is arranged in the predetermined location. By detecting that it is also with the light-receiving means 2 and the distance operation means 3 about this displacement side 102, the location of the light beam in a scanning direction is detected.

[0047] If it is in the light-scanning mold displacement measurement equipment of this 4th operation gestalt Since the proofreading means was formed in the scanning zone of a light beam as the diffuse reflection body 10 which allotted two displacement sides 102 displaced from datum level 101 to the orientation is also as described above Since the light beam irradiated by the diffuse reflection body 10 carries out diffuse reflection, receive the reflected light with the light-receiving means 2, the distance operation means 3 detects the displacement side 102, a gap of the location from a predetermined location is proofread by two points, and proofreading precision can be made high and it is added independently, a miniaturization becomes possible.

[0048]

[Effect of the Invention] Since a proofreading means proofreads the amount of gaps from the predetermined location set up in early stages of the light beam in a scanning direction, the input-output behavioral characteristics of a location detection means detect the location of a light beam can change with secular change etc. from initial value, and a thing according to claim 1 can proofread a light beam in a predetermined location, when the location of a light beam shifts from a predetermined location, and

can maintain the location precision in the scanning direction of a light beam for a long period of time.

[0049] Since in addition to the effectiveness of a thing according to claim 1 the proofreading means was formed as it is also at the location sensing element which detects a location with high degree of accuracy, a thing according to claim 2 detects the location of a light beam with a sufficient precision. Since the light beam could be proofread with high degree of accuracy in the predetermined location and it was prepared in the both ends of the scanning zone of a light beam, respectively, a gap of the location from a predetermined location can be proofread by two points of both ends, and proofreading precision can be made still higher.

[0050] If a stand is contained by housing in addition to the effectiveness of a thing according to claim 1, a thing according to claim 3 One of the photo interrupters with which it is shaded with two or more gobos or its gobo, and a proofreading means outputs a protection-from-light signal to a stand Since another side was prepared and formed in housing, and a gobo is plurality, a gap of the location from a predetermined location is proofread by two or more points, and proofreading precision can be made high. And a complicated digital disposal circuit cannot be needed, but the location of a light beam can be detected as it is also with a direct protection-from-light signal, and a cost cut can be realized.

[0051] If a light beam is irradiated through a floodlighting aperture in addition to the effectiveness of a thing according to claim 1, since the proofreading means was formed as it is also at a floodlighting aperture shorter than the scanning zone of a light beam, a thing according to claim 4 can detect the location of a light beam by change of the light income of the light-receiving means in the both ends of a floodlighting aperture, does not need to add a member newly, and can realize a cost cut.

[0052] A thing according to claim 5 in the effectiveness of a thing according to claim 1 in addition, a proofreading means Since it was formed in the scanning zone of a light beam that the diffuse reflection body which allotted two or more displacement sides displaced from datum level to the orientation is also Since the light beam irradiated by the diffuse reflection body receives the reflected light of diffuse reflection Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. with a light-receiving means, a distance operation means detects a displacement side, a gap of the location from a predetermined location is proofread by two or more points, and proofreading precision can be made high and it is added independently, a miniaturization becomes possible.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the 1st operation gestalt of this invention.

[Drawing 2] It is the operation part block diagram of a proofreading means same as the above.

[Drawing 3] It is the correspondence Fig. of the image formation location of the 3rd location sensing element same as the above, and the division output value of operation part.

[Drawing 4] It is the correspondence Fig. of the output value by the location detection means same as the above, and the predetermined location of the light beam in the scanning direction detected by the 3rd location sensing element.

[Drawing 5] It is the perspective view showing the 2nd operation gestalt of this invention.

[Drawing 6] It is drawing showing the 3rd operation gestalt of this invention.

[Drawing 7] It is the correspondence Fig. of the scan distance of a light beam same as the above, and the light income of the 1st location sensing element.

[Drawing 8] It is the perspective view showing the 4th operation gestalt of this invention.

[Drawing 9] It is the principle Fig. of a triangulation method showing the conventional example.

[Description of Notations]

1 Floodlighting Means

2 Light-receiving Means

12a Light emitting/receiving flat surface

3 Distance Operation Means

4 Scan Means

43 Stand

5 Location Detection Means

6 Housing

71 3rd Location Sensing Element (Proofreading Means)

81 Gobo (Proofreading Means)

82 Photo Interrupter (Proofreading Means)

91 Floodlighting Aperture (Proofreading Means)

10 Diffuse Reflection Body (Proofreading Means)

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平9－257418

(43)公開日　平成９年(1997)10月３日

(51)Int.Cl.[6]	識別記号	庁内整理番号	Ｆ Ｉ		技術表示箇所
Ｇ０１Ｂ　11/00			Ｇ０１Ｂ　11/00	Ｆ	
Ｇ０１Ｃ　3/06			Ｇ０１Ｃ　3/06	Ａ	

審査請求　未請求　請求項の数５　ＯＬ　（全 10 頁）

(21)出願番号　特願平8－69862

(22)出願日　平成８年(1996)３月26日

(71)出願人　000005832
松下電工株式会社
大阪府門真市大字門真1048番地

(72)発明者　橋本　健
大阪府門真市大字門真1048番地松下電工株式会社内

(72)発明者　伊藤　隆康
大阪府門真市大字門真1048番地松下電工株式会社内

(72)発明者　広野　淳之
大阪府門真市大字門真1048番地松下電工株式会社内

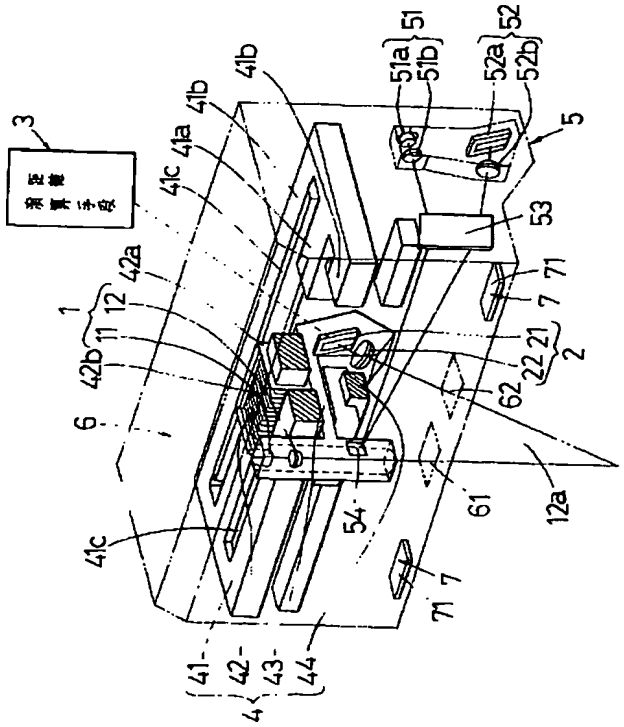
(74)代理人　弁理士　佐藤　成示　（外１名）

(54)【発明の名称】　光走査型変位測定装置

(57)【要約】

【課題】　光ビームの走査方向での位置を初期に設定した所定位置に維持することができる光走査型変位測定装置を提供する。

【解決手段】　被測定物に光ビームを照射して投光スポットを形成する投光手段１と、投光スポットからの反射光を受光してその受光位置に対応して信号を出力する受光手段２と、被測定物の基準面からその基準面と変位した変位面までの距離を受光手段２からの信号に基づいて演算する距離演算手段３と、投光手段１及び受光手段２を定位置に取り付けた架台４３が走行して光ビームを走査する走査手段４と、光ビームの走査方向での位置を検出する位置検出手段５と、を備え、被測定物の表面を光ビームが走査して、投受光平面１２ａの三角形を測定する三角測量法でもって測定する光走査型変位測定装置において、走査方向における前記光ビームの所定位置からのずれ量を校正する校正手段７１が設けられた構成にしてある。



【特許請求の範囲】
【請求項１】　被測定物に光ビームを照射して投光スポットを形成する投光手段と、投光スポットからの反射光を受光してその受光位置に対応して信号を出力する受光手段と、被測定物の基準面からその基準面と変位した変位面までの距離を受光手段からの信号に基づいて演算する距離演算手段と、投光手段及び受光手段を定位置に取り付けた架台が走行して光ビームを走査する走査手段と、光ビームの走査方向での位置を検出する位置検出手段と、を備え、被測定物の表面を光ビームが走査して、基準面から変位面までの距離を光ビームの投光軸と反射光の受光軸とで形成される投受光平面の三角形を測定する三角測量法でもって測定する光走査型変位測定装置において、
走査方向における前記光ビームの所定位置からのずれ量を校正する校正手段が設けられたことを特徴とする光走査型変位測定装置。
【請求項２】　前記校正手段が、前記光ビームの走査範囲の両端部にそれぞれ設けられて前記光ビームの位置を検出する位置検出素子でもって形成されてなることを特徴とする請求項１記載の光走査型変位測定装置。
【請求項３】　前記架台がハウジングに収納されたものであって、前記校正手段が、複数の遮光板又はその遮光板で遮光されて遮光信号を出力するフォトインタラプタのどちらか一方が架台に、他方がハウジングに設けられて形成されてなることを特徴とする請求項１記載の光走査型変位測定装置。
【請求項４】　前記光ビームが投光窓を介して照射されるものであって、前記校正手段が、前記光ビームの走査範囲より短い投光窓でもって形成されてなることを特徴とする請求項１記載の光走査型変位測定装置。
【請求項５】　前記校正手段が、前記光ビームの走査範囲内に前記基準面から変位した複数の前記変位面を所定位置に配して前記光ビームを拡散反射する拡散反射物体でもって形成されてなることを特徴とする請求項１記載の光走査型変位測定装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、被測定物の表面を光ビームが走査して、被測定物の基準面からその基準面と変位した変位面までの距離を三角測量法に基づいて測定する光走査型変位測定装置に関するものである。
【０００２】
【従来の技術】従来、この種の光走査型変位測定装置として、図９に示す構成のものが存在する。このものは、被測定物に光ビームを照射して投光スポットを形成する投光手段Ａと、投光スポットからの反射光を受光してその受光位置Ｂ１に対応して信号を出力する受光手段Ｂと、被測定物の基準面からその基準面と変位した変位面までの距離を受光手段からの信号に基づいて演算する距離演算手段と、投光手段Ａ及び受光手段Ｂを定位置に取り付けた架台が走行して光ビームを走査する走査手段と、光ビームの走査方向での位置を検出する位置検出手段と、を備えたものが存在する。
【０００３】さらに詳しくは、投光手段Ａは半導体レーザ等の光源部Ａ２と投光レンズＡ３とで、また受光手段Ｂは位置を検出する受光素子Ｂ２と受光レンズＢ３とでそれぞれ形成されている。被測定物の基準面Ａ１が変位したとき、基準面Ａ１から変位面Ａ４までの距離を光ビームの投光軸Ａ５と反射光の受光軸Ｂ４とで形成される投受光平面Ｃの三角形を測定する三角測量法でもって測定することができる。
【０００４】すなわち、受光レンズＢ３の中心から投光軸Ａ５におろした垂線の長さ、投光軸Ａ５と受光軸Ｂ４とで形成される受光角、及び受光レンズＢ３と受光素子Ｂ２との距離をそれぞれ一定値に設定すると、基準面Ａ１での反射光の受光位置Ｂ１から変位面Ａ４での受光位置Ｂ５までの距離を実測することでもって、基準面Ａ１から変位面Ａ４までの距離つまり変位量を測定することができる。
【０００５】また、位置検出手段は、投光部と受光部と距離演算部とで形成されて、上記した三角測量法の原理で光ビームの走査方向での位置を検出している。
【０００６】
【発明が解決しようとする課題】上記した従来の光走査型変位測定装置では、光ビームが被測定物の表面を走査して、被測定物からの反射光を受光することによって、基準面からの被測定物の変位を測定できる。
【０００７】しかしながら、光ビームの位置を検出する位置検出手段は、受光部又は距離演算部等の入出力特性が経年変化等により初期値から変化する場合があり、このとき、走査方向における光ビームの位置が初期に設定された所定位置からずれる場合があった。例えば、走査範囲を１００ｍｍとしたとき、入出力特性が０．１％変化したとすれば０．１ｍｍのずれ量となって、これが誤差となっていた。
【０００８】本発明は、上記事由に鑑みてなしたもので、その目的とするところは、光ビームの走査方向での位置を初期に設定した所定位置に維持することができる光走査型変位測定装置を提供することにある。
【０００９】
【課題を解決するための手段】上記した課題を解決するために、請求項１記載のものは、被測定物に光ビームを照射して投光スポットを形成する投光手段と、投光スポットからの反射光を受光してその受光位置に対応して信号を出力する受光手段と、被測定物の基準面からその基準面と変位した変位面までの距離を受光手段からの信号に基づいて演算する距離演算手段と、投光手段及び受光手段を定位置に取り付けた架台が走行して光ビームを走査する走査手段と、光ビームの走査方向での位置を検出

する位置検出手段と、を備え、被測定物の表面を光ビームが走査して、基準面から変位面までの距離を光ビームの投光軸と反射光の受光軸とで形成される投受光平面の三角形を測定する三角測量法でもって測定する光走査型変位測定装置において、走査方向における前記光ビームの所定位置からのずれ量を校正する校正手段が設けられた構成にしてある。

【００１０】請求項２記載のものは、請求項１記載のものにおいて、前記校正手段が、前記光ビームの走査範囲の両端部にそれぞれ設けられて前記光ビームの位置を検出する位置検出素子でもって形成された構成にしてある。

【００１１】請求項３記載のものは、請求項１記載のものにおいて、前記架台がハウジングに収納されたものであって、前記校正手段が、複数の遮光板又はその遮光板で遮光されて遮光信号を出力するフォトインタラプタのどちらか一方が架台に、他方がハウジングに設けられて形成された構成にしてある。

【００１２】請求項４記載のものは、請求項１記載のものにおいて、前記光ビームが投光窓を介して照射されるものであって、前記校正手段が、前記光ビームの走査範囲より短い投光窓でもって形成された構成にしてある。

【００１３】請求項５記載のものは、請求項１記載のものにおいて、前記校正手段が、前記光ビームの走査範囲内に前記基準面から変位した複数の前記変位面を所定位置に配して前記光ビームを拡散反射する拡散反射物体でもって形成された構成にしてある。

【００１４】

【発明の実施の形態】本発明の第１実施形態を図１乃至図４に基づいて以下に説明する。

【００１５】１は投光手段で、半導体レーザ又は発光ダイオードからなる光源部１１と透明樹脂からなる投光レンズ１２とを設けて、光源部１１から発光した光線が投光レンズ１２でもって平行光線束となって、被測定物の表面に光ビームを照射して投光スポットを形成する。

【００１６】２は受光手段で、半導体からなる第１位置検出素子２１と透明樹脂からなる受光レンズ２２とを設けて、投光スポットからの反射光を受光レンズ２２でもって収束し第１位置検出素子２１の受光面に結像して、第１位置検出素子２１が結像位置に、すなわち受光位置に、対応して両端に２種類の電流信号を出力する。

【００１７】３は距離演算手段で、マイクロコンピュータ等の演算素子により、第１位置検出素子２１から出力された２種類の電流信号に基づいて、測定物の基準面からその基準面と変位した変位面までの距離を演算する。

【００１８】４は走査手段で、ヨーク４１、可動子４２、架台４３、及びガイドレール４４で形成されている。ヨーク４１は、磁性材料により、中央片４１ａと対向片４１ｂとで略日字状に形成され、２個の対向片４１ｂが中央片４１ａの対向面に永久磁石４１ｃをそれぞれ固着している。２個の永久磁石４１ｃは中央片４１ａの対向面と対向片４１ｂの固着面とが異極になるよう、また、中央片４１ａの対向面がそれぞれ同極になるよう着磁されている。

【００１９】可動子４２は、中央片４１ａが挿通されたボビン４２ａを有し、ボビン４２ａ内を通る磁力線が中央片４１ａの長手方向に形成されるよう、ボビン４２ａにコイル４２ｂが巻回されている。また、ボビン４２ａが、中央片４１ａの長手方向に走行自在となるように、寸法を設定している。コイル４２ｂは、永久磁石４１ｃとヨーク４１の中央片４１ａとの間隙で磁束が通過することになって、直流電流が通電されると駆動力が作用して、可動子４２が中央片４１ａの長手方向に沿って走行することになる。また、可動子４２の走行の方向はコイル４２ｂに流す電流の通電方向に応じて反転し、加速度は電流の大きさに対応する。

【００２０】架台４３は、投光手段１及び受光手段２を定位置に固定し、可動子４２に取り付けられて中央片４１ａの長手方向に沿って走行して、光ビームを走査する。ガイドレール４４は、ヨーク４１の長手方向に沿って略平行に設けられ、架台４３が係合されてがたつきなく走行できるようガイドする。

【００２１】５は位置検出手段で、投光部５１、受光部５２、反射鏡５３、反射板５４、及び距離演算部（図示せず）とで形成される。投光部５１は、半導体レーザ又は発光ダイオードからなる光源５１ａと透明樹脂からなる位置検出用投光レンズ５１ｂとを設けて、光源５１ａから発光された光線が位置検出用投光レンズ５１ｂでもって平行光線束となって光ビームを照射する。

【００２２】受光部５２は、半導体からなる第２位置検出素子５２ａと透明樹脂からなる位置検出用受光レンズ５２ｂとを設けて、後述する反射板５４からの反射光を位置検出用受光レンズ５２ｂでもって収束し第２位置検出素子５２ａの受光面に結像して、その結像位置に対応して両端に２種類の電流信号を出力する。

【００２３】反射鏡５３は、投光部５１からの光ビームの投光軸に交差するよう後述するハウジング６に設けられて、光ビームを反射させてその方向を変更する。反射板５４は、白色のセラミック板により、投光手段１を収納した投光筒の側面に固定されて、投光手段１からの光ビームの走査と連動して走査方向に移動する。距離演算部は、第２位置検出素子５２ａから出力された２種類の電流信号に基づいて、反射板５４までの距離を演算してその演算結果を出力する。

【００２４】６はハウジングで、略直方体状に成形され、投光手段１、受光手段２、距離演算手段３、走査手段４及び位置検出手段５のそれぞれを収容し、光ビームの投光軸に位置する部分６１及び反射光の受光軸に位置する部分６２が、それぞれ開口している。

【００２５】７は校正手段で、半導体からなり光ビーム

の走査範囲の両端部に位置するハウジング６にそれぞれ１個づつ設けられた第３位置検出素子７１と、第３位置検出素子７１から出力された電流信号を演算する演算部７２とを設けて、投光手段１からの光ビームの位置を検出する。このものについては詳しく後述する。

【００２６】ここで、投光手段１及び受光手段２は、光ビームの投光軸と反射光の受光軸とが投受光平面１２ａを形成するよう配置されて、この投受光平面１２ａに直交して第１位置検出素子２１の受光面が設けられている。従って、光ビームの照射方向において被測定物の基準面が変位すれば、第１位置検出素子２１の受光面に結像した被測定物の結像位置が移動する。この被測定物の結像位置の移動量を、第１位置検出素子２１の出力に基づいて距離演算手段３でもって演算して求めると、先述した三角測量法の原理でもって、光ビームの照射方向における被測定物の基準面からその基準面と変位した変位面までの距離を測定することができる。

【００２７】また、走査手段４を用いて架台４３を往復運動させて光ビームを走査して、その走査方向での光ビームの位置が位置検出手段５でもって検出される。すなわち、投光部５１からの光ビームが反射鏡５３を介して反射板５４に向かって照射されて、反射板５４からの反射光が同様に反射鏡５３を介して第２位置検出素子５２ａに入射される。ここで、光ビームの投光軸と反射板５４からの反射光の受光軸とは、反射鏡５３を介して投受光平面を形成して、この平面と直交するよう第２位置検出素子５２ａの受光面が設けられている。

【００２８】走査方向での光ビームの位置に連動して反射板５４の位置が変化して、第２位置検出素子５２ａの受光面で反射板５４の結像位置が移動する。この反射板５４の結像位置の移動量を、第２位置検出素子５２ａの出力に基づいて距離演算部でもって演算して求めると、先述した三角測量法の原理でもって、反射板５４の位置、すなわち走査方向での光ビームの位置を求めることができる。ここで、初期において、走査方向での光ビームの所定位置が、第２位置検出素子５２ａから出力される２種類の電流値でもって決定されている。

【００２９】走査方向における光ビームの所定位置からのずれ量の校正について述べる。第３位置検出素子７１は、２種類の電流が投光手段１からの光ビームを受光して出力される。両電流出力の差は第３位置検出素子７１の受光面上での結像位置に対応しており、また、両電流出力の和は受光する総受光量に対応しこの場合一定である。

【００３０】図２に示すように、第３位置検出素子７１から出力される両電流信号のそれぞれは、回路部のＩ／Ｖ変換回路７２ａにおいて電圧信号に変換され、ハイパスフィルタ７２ｂを通過することによって変調回路７２ｃで変調された高周波成分が抽出される。ハイパスフィルタ７２ｂの出力は、検波回路７２ｄによって発振回路７２ｅからのクロックパルスに同期されて同期検波されて、検波出力からローパスフィルタ７２ｆで低周波成分が抽出される。ローパスフィルタ７２ｆの出力は、第３位置検出素子７１の各電流出力にそれぞれ比例した値の電圧信号になる。その両電圧信号を加算回路７２ｇ及び減算回路７２ｈでそれぞれ加算及び減算して、除算回路７２ｉでその結果である差を和で除算する。この除算出力値が結像位置に対応した値となる。

【００３１】ここで、図３に示すように、第３位置検出素子７１の両出力の差を和で除算した除算出力値と、結像位置とが対応した対応関係に、一定の敷居値を決めることによって光ビームの結像位置が確定される。

【００３２】光ビームの走査方向における、位置検出手段５による出力値と光ビームの所定位置との対応を図４に示す。初期において、図４の実線に示すように、光ビームの所定位置Ｙは位置検出手段５による出力値ＸとＹ＝ａＸ+ｂで表される直線でリニアに対応しており、光ビームの位置がこの直線に基づいて位置検出手段５の距離演算部で演算して求められている。そして、第３位置検出素子７１は、この直線の両端部７１ａ，７１ｂに相当する所定位置が敷居値から求めた光ビームの結像位置とそれぞれ対応して、光ビームの位置を検出する。

【００３３】位置検出手段５の入出力特性が変化し出力位置が変動して、図４の破線に示すように、所定値からのずれが発生した場合、第３位置検出素子７１で検出された直線の両端部７１ａ，７１ｂに相当する光ビームの所定位置において、位置検出手段５の出力値が初期の出力値となるよう、前式におけるａとｂとを正しい値に補正して、光ビームの所定位置からのずれ量を校正する。

【００３４】かかる第１実施形態の光走査型変位測定装置にあっては、上記したように、校正手段７が走査方向における光ビームの初期に設定された所定位置からのずれ量を校正するから、光ビームの位置を検出する位置検出手段５の入出力特性が経年変化等により初期値から変化して、光ビームの位置が所定位置からずれたとき光ビームを所定位置に校正して、光ビームの走査方向での位置精度を長期間維持することができる。

【００３５】また、校正手段７が位置を高精度で検出する第３位置検出素子７１でもって形成されたから、光ビームの位置を敷居値を設けて精度よく検出して、光ビームを所定位置に高精度で校正することができ、かつ、光ビームの走査範囲の両端部にそれぞれ設けられたから、両端部の２点で所定位置からの位置のずれを校正して、校正精度をさらに高くすることができる。

【００３６】なお、第１実施形態では、２種類の電流を出力してその出力の差で光ビームの位置を検出する第３位置検出素子でもって校正手段を形成したが、例えば、シリコン基板上に電極アレーを設けた電荷結合素子（ＣＣＤ）でもって形成してもよく、高精度で光ビームの位置を検出できる素子であればよく、限定されない。

【００３７】また、第１実施形態では、光ビームの走査方向での位置を光学式三角測量法でもって測定したが、例えば、リニアエンコーダを使用した光学式測定方式、又は光学式ヘテロダイン測距方式のような他の光学式測距方式でもよく、限定されない。

【００３８】本発明の第２実施形態を図５に基づいて以下に説明する。なお、第２実施形態では第１実施形態と異なる機能について述べることとし、第１実施形態と実質的に同一機能を有する部材については、同一符号を付して説明を省略する。

【００３９】８は校正手段で、２個の遮光板８１が走査範囲の両端部位置におけるハウジング６に、フォトインタラプタ８２が架台４３にそれぞれ設けられている。フォトインタラプタ８２は、光ビームの走査と連動し位置が移動して、走査範囲の両端部で遮光板８１でもって遮光され遮光信号を出力して、その遮光信号でもって光ビームの走査方向における位置を検出する。

【００４０】かかる第２実施形態の光走査型変位測定装置にあっては、上記したように、校正手段８が、２個の遮光板８１がハウジング６に、その遮光板８１で遮光されて遮光信号を出力するフォトインタラプタ８２が架台４３に設けられて形成されたから、遮光板８１が２個であるので所定位置からの位置のずれを２点で校正することになって校正精度を高くでき、かつ、複雑な信号処理回路を必要とせず直接遮光信号でもって光ビームの位置を検出して、コストダウンを実現することができる。

【００４１】本発明の第３実施形態を図６乃び図７に基づいて以下に説明する。なお、第３実施形態では第１実施形態と異なる機能について述べることとし、第１実施形態と実質的に同一機能を有する部材については、同一符号を付して説明を省略する。

【００４２】９は校正手段で、ハウジング６に設けられた投光窓９１でもって形成されて、その投光窓９１が光ビームの走査範囲より短かく設定されている。従って、走査範囲の両端部において、光ビームはハウジング６で遮蔽される。拡散反射率のよい白色のセラミック板９２を基準面に置いて光ビームを走査したとき、図７に示すように、受光手段１の第１位置検出素子２１の受光量は投光窓９１の両端部で変化して傾斜部を形成する。投光窓９１の範囲内の受光量をＸとしたとき、たとえば、０．５Ｘを敷居値として、光ビームの位置を検出する。

【００４３】かかる第３実施形態の光走査型変位測定装置にあっては、上記したように、校正手段９が光ビームの走査範囲より短い投光窓９１でもって形成されたから、光ビームの位置を投光窓９１の両端部における受光手段１の受光量の変化で検出して、新規に部材を付加する必要がなくコストダウンを実現することができる。

【００４４】なお、第３実施形態では、基準面に白色のセラミック板を置いて校正したが、拡散反射率のよいものであればセラミック板でなくてもよく、限定されない。

【００４５】本発明の第４実施形態を図８に基づいて以下に説明する。なお、第４実施形態では第１実施形態と異なる機能について述べることとし、第１実施形態と実質的に同一機能を有する部材については、同一符号を付して説明を省略する。

【００４６】校正手段は、光ビームを拡散反射する拡散反射物体１０により、基準面１０１を有した基準片と基準片から略直交して設けられた位置決め片とで略Ｌ字型に形成され、光ビームの走査範囲内に、基準面から変位した２個の変位面１０２が設けられている。位置決め片がハウジング６と係合して位置決めされて、変位面１０２が所定位置に配置されている。この変位面１０２を受光手段２及び距離演算手段３でもって検出することによって、走査方向における光ビームの位置を検出する。

【００４７】かかる第４実施形態の光走査型変位測定装置にあっては、上記したように、校正手段が、光ビームの走査範囲内に基準面１０１から変位した２個の変位面１０２を定位置に配した拡散反射物体１０でもって形成されたから、拡散反射物体１０に照射された光ビームが拡散反射してその反射光を受光手段２で受光して距離演算手段３で変位面１０２を検出し、２点で所定位置からの位置のずれを校正して、校正精度を高くでき、かつ、独立して付加されるので小型化が可能となる。

【００４８】

【発明の効果】請求項１記載のものは、校正手段が走査方向における光ビームの初期に設定された所定位置からのずれ量を校正するから、光ビームの位置を検出する位置検出手段の入出力特性が経年変化等により初期値から変化して、光ビームの位置が所定位置からずれたとき光ビームを所定位置に校正して、光ビームの走査方向での位置精度を長期間維持することができる。

【００４９】請求項２記載のものは、請求項１記載のものの効果に加えて、校正手段が位置を高精度で検出する位置検出素子でもって形成されたから、光ビームの位置を精度よく検出して、光ビームを所定位置に高精度で校正することができ、かつ、光ビームの走査範囲の両端部にそれぞれ設けられたから、両端部の２点で所定位置からの位置のずれを校正して、校正精度をさらに高くすることができる。

【００５０】請求項３記載のものは、請求項１記載のものの効果に加えて、架台がハウジングに収納されたものであれば、校正手段が、複数の遮光板又はその遮光板で遮光されて遮光信号を出力するフォトインタラプタのどちらか一方が架台に、他方がハウジングに設けられて形成されたから、遮光板が複数であるので複数点で所定位置からの位置のずれを校正して校正精度を高くでき、かつ、複雑な信号処理回路を必要とせず直接遮光信号でもって光ビームの位置を検出して、コストダウンを実現することができる。

【００５１】請求項４記載のものは、請求項１記載のものの効果に加えて、光ビームが投光窓を介して照射されるものであれば、校正手段が光ビームの走査範囲より短い投光窓でもって形成されたから、光ビームの位置を投光窓の両端部における受光手段の受光量の変化で検出して、新規に部材を付加する必要がなくコストダウンを実現することができる。

【００５２】請求項５記載のものは、請求項１記載のものの効果に加えて、校正手段が、光ビームの走査範囲内に基準面から変位した複数の変位面を定位置に配した拡散反射物体でもって形成されたから、拡散反射物体に照射された光ビームが拡散反射しその反射光を受光手段で受光し距離演算手段で変位面を検出して、複数点で所定位置からの位置のずれを校正して、校正精度を高くでき、かつ、独立して付加されるので小型化が可能となる。

【図面の簡単な説明】

【図１】本発明の第１実施形態を示す斜視図である。

【図２】同上の校正手段の演算部ブロック図である。

【図３】同上の第３位置検出素子の結像位置と演算部の除算出力値との対応図である。

【図４】同上の位置検出手段による出力値と第３位置検出素子で検出された走査方向における光ビームの所定位置との対応図である。

【図５】本発明の第２実施形態を示す斜視図である。

【図６】本発明の第３実施形態を示す図である。

【図７】同上の光ビームの走査距離と第１位置検出素子の受光量との対応図である。

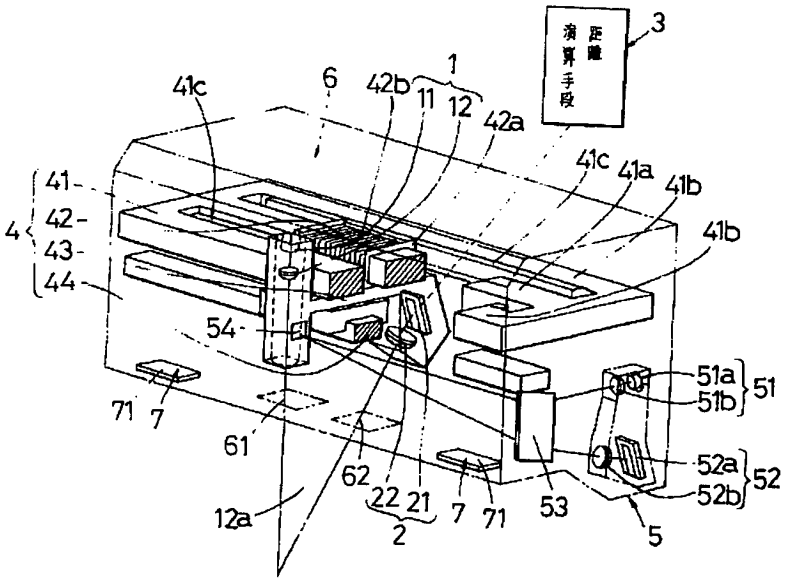
【図８】本発明の第４実施形態を示す斜視図である。

【図９】従来例を示す三角測量法の原理図である。

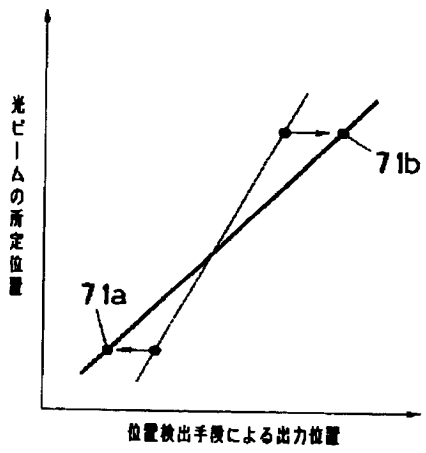
【符号の説明】

１	投光手段
２	受光手段
１２ａ	投受光平面
３	距離演算手段
４	走査手段
４３	架台
５	位置検出手段
６	ハウジング
７１	第３位置検出素子（校正手段）
８１	遮光板（校正手段）
８２	フォトインタラプタ（校正手段）
９１	投光窓（校正手段）
１０	拡散反射物体（校正手段）

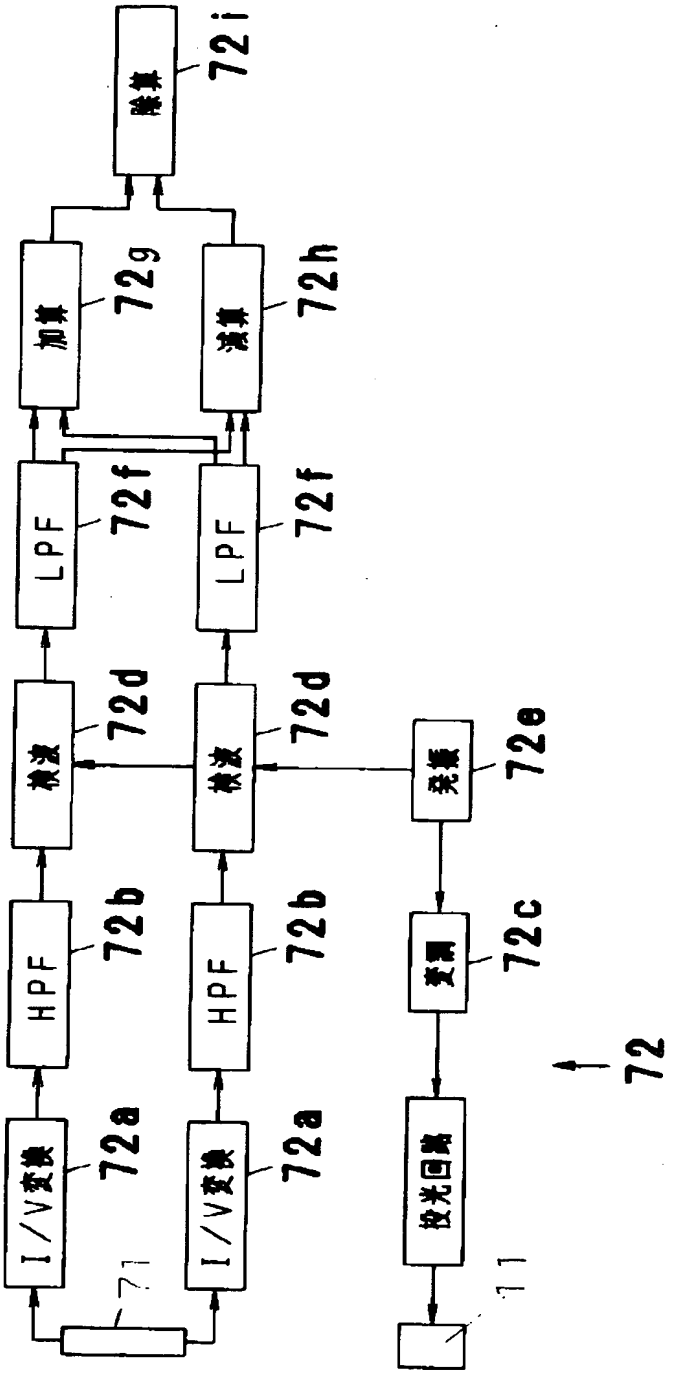
【図１】



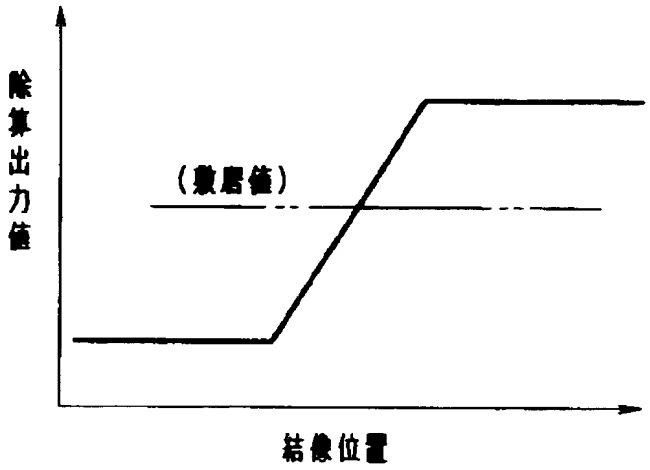
【図４】



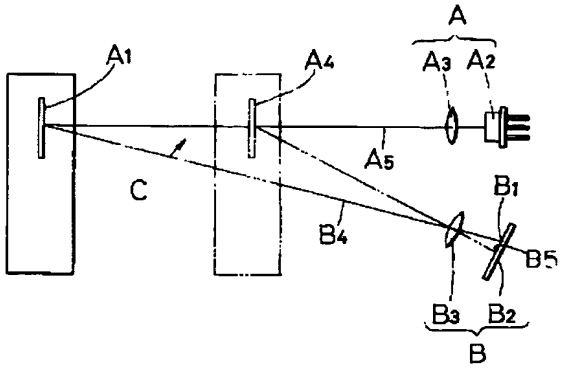
【図2】


除算
72i
加算
72g
減算
72h
LPF
72f
LPF
72f
検波
72d
検波
72d
発振
72e
HPF
72b
HPF
72b
変調
72c
I/V変換
72a
I/V変換
72a
投光回路
72
71
11

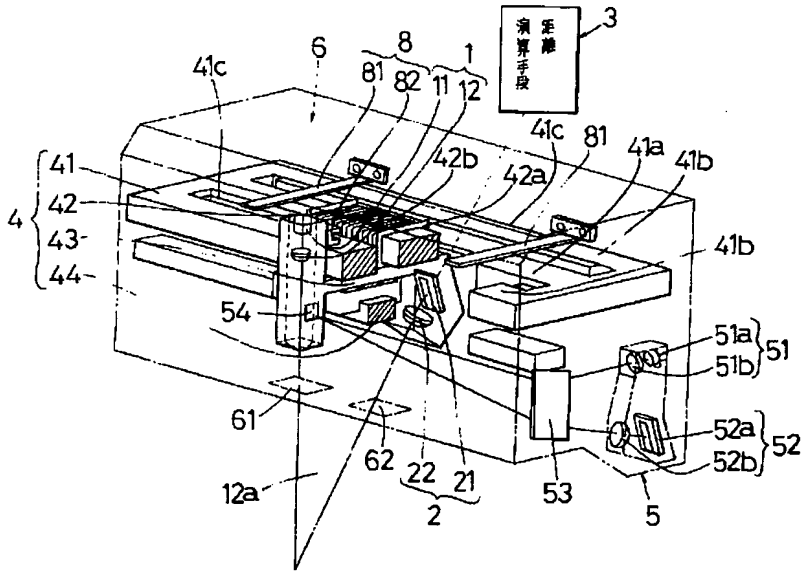
【図3】


除算出力値
（最適値）
結像位置

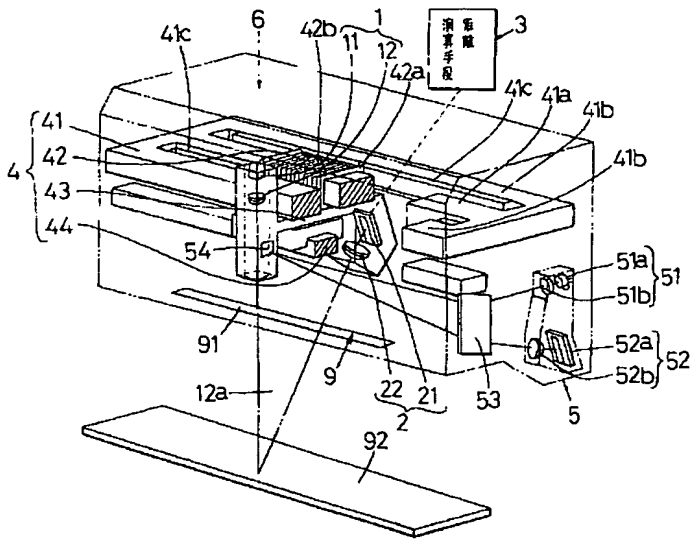
【図9】


A
A1
A4
A3
A2
A5
C
B1
B4
B5
B3
B2
B

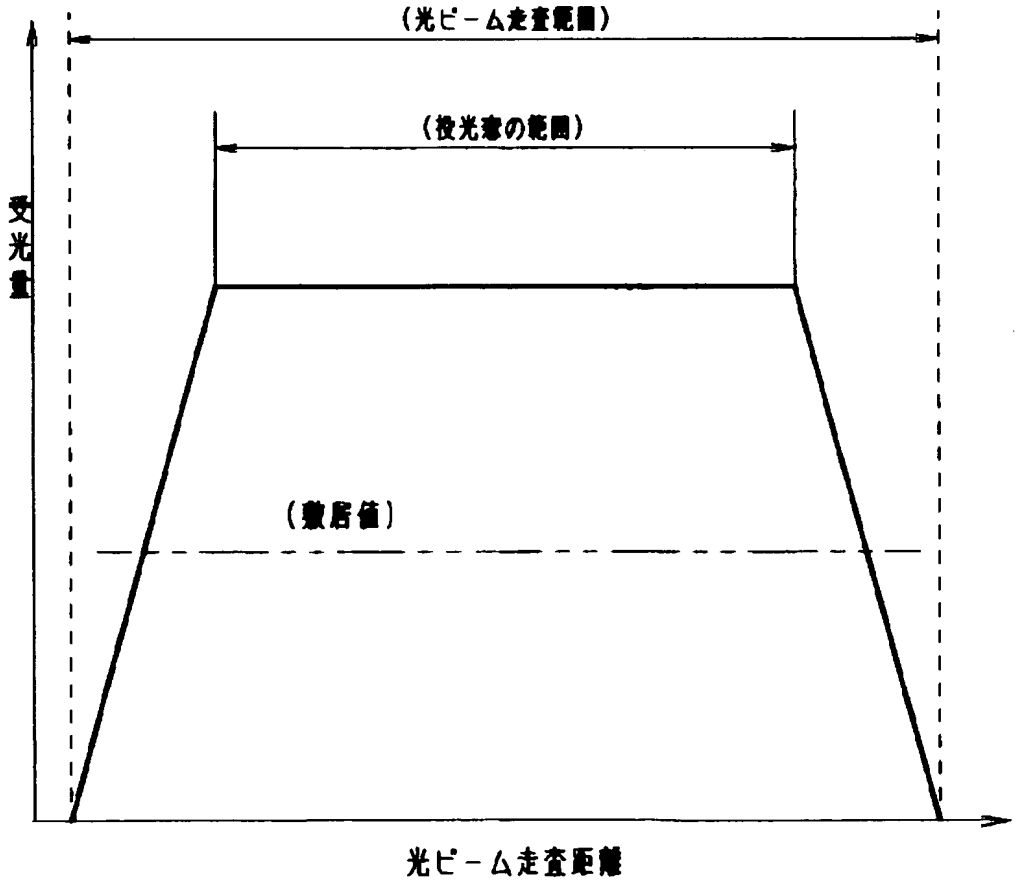
【図5】


3
演算手段
距離
6
8
1
81
82
11
12
41c
41c
81
41a
41b
42b
42a
41
42
43
44
4
41b
54
51a
51b
51
61
62
22
21
52a
52b
52
12a
2
53
5

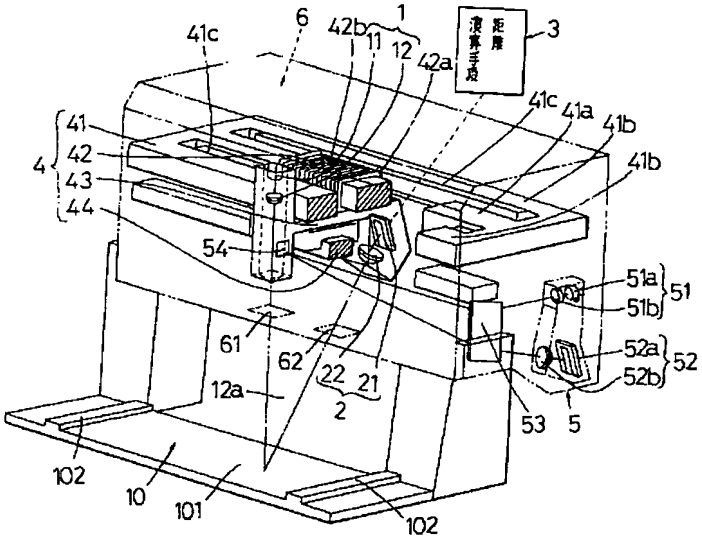
【図６】


6
41c
42b
1
11
12
42a
3
演算手段
41c
41a
41b
41b
41
42
43
44
4
54
51a
51b
51
52a
52b
52
91
9
22
21
2
53
5
12a
92

【図７】


（光ビーム走査範囲）
（投光窓の範囲）
受光量
（敷居値）
光ビーム走査距離

【図８】


41c
6
42b
1
11
12
42a
3
41c
41a
41b
41b
41
42
43
44
4
54
51a
51b
51
52a
52b
52
61
62
22
21
2
12a
53
5
102
10
101
102